

Application Serial No. 09/513,702
Amendment Dated March 22, 2004
Reply to Office Action of November 20, 2003

REMARKS

This Amendment is submitted in response to the Office Action Mailed November 20, 2003, wherein Claims 1, 3-4, 9, 12, 15-17, 20, 25, 27, and 29 were rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. to Aoki, *et al.* (the "Aoki patent") in view of U.S. patent No. 5,737,474 to Hayashi, *et al.* (the "Hayashi patent"), and wherein Claims 2, 5-8, 10-11, 13-14, 18-19, 21-24, 26, and 28 were rejected under 35 U.S.C. §103(a) as being obvious over the Aoki patent in view of the Hayashi patent, and further in view of U.S. Patent No. 6,122,299 to DeMars, *et al.* (the "DeMars patent").

Applicants respectfully thank the Examiner and her Supervisor, Examiner Paul Ip, for the courtesy they extended to Applicants' representatives, Messrs. Yamamoto and Irikawa, during the Interview held on March 8, 2004. The invention, the outstanding rejections, and the Aoki and Hayashi patents were discussed during the interview. Also during the interview, suggested claim amendments were presented and discussed. No agreement was reached on the claims.

With this Amendment, Applicants provide a number of voluntary amendments to the pending independent claims, Claims 1 and 29 to improve the claims along the lines suggested by the Examiners. Applicants also traverse the pending rejections by arguing that the Aoki and Hayashi patents teach against the *prima facie* combination suggested by the Rejections. **Claims 1-29 and new Claim 30 are pending.**

Voluntary Amendments to Claims 1 and 29

In the preambles of Claims 1 and 29, the word "pumping" has been removed so as to conform the preambles to the preamble of original Claim 1. The word "pumping" was previously added under a voluntary amendment. As the amended preambles are the same as the preamble of original Claim 1, Applicants respectfully submit that no new matter has been entered.

In the second paragraphs of Claims 1 and 29, the length of the cavity portion has been amended to be greater than 1200 μm . Support for the amendment appears on page 9, lines 24-25 of the Specification as originally filed. Accordingly, Applicants respectfully submit that no new matter has been entered.

In the third paragraphs of Claims 1 and 29, several changes have been made. First, part of the last clause ("formed on a substrate") has been moved forward in the paragraph, and

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remaining part ("having at least a portion disposed in said cavity portion") has been rephrased for clarity to read as "said resonator cavity comprising at least a portion of said laminated structure." Among other places, support for these amendments appear on page 11, lines 22-31 of the original Specification, where it is disclosed that two cladding layers and an active layer 3 having two quantum wells are formed on a substrate, with the upper part of the laminated structure being formed into a mesa structure. As is known in the art, the light in the resonator cavity is generated in and below the mesa structure, and thus it can be stated that "said resonator cavity comprising at least a portion of said laminated structure." As additional amendments, language has been added to recite that the laminated structure comprises "a lower cladding layer, an active layer disposed over the lower cladding layer, and an upper cladding layer disposed over the active layer." Support for this language appears on page 11, lines 22-31 of the original Specification, where these layers are described, and in FIG. 2 of the application and other locations of the application. In addition, language has been added to the third paragraph to recite that "the upper cladding layer having a mesa stripe that is oriented along the cavity length, the top of the mesa stripe being configured to receive current applied to the laser device." The term "mesa stripe" has its ordinary meaning in the semiconductor laser art as a raised and elongated body of material (e.g., of the upper cladding layer) is supported by the description of the mesa structure on page 11, lines 22-31 of the original specification. Support for the mesa stripe being oriented along the cavity length is provided by FIGS. 1 and 2 of the original application, where FIG. 1 shows a view of the device along the cavity length L, and FIG. 2 shows a cross-section thereof which has the mesa stripe. Finally, as shown in FIG. 2, the top of the mesa stripe is configured to contact cap layer 5, and is thereby configured to receive current applied to the laser device by way of electrode 7 and cap layer 5. It is well settled that the drawings of the specification may be relied upon to support claim amendments. *In Re Reynolds*, 170 U.S.P.Q. 97 (C.C.P.A. 1971); *Ex parte Horton*, 226 U.S.P.Q. 697 (P.T.O. Bd. App. I. 1985). (Ancillary to this, as indicated by M.P.E.P. § 2163.07(a), a claim may be amended to recite features that are inherent in the device.) Accordingly, Applicants respectfully submit that the amendments to the third paragraphs of Claim 1 and 29 are supported by the original application and do not enter new matter.

A fourth paragraph has been added to each of independent Claims 1 and 29 to recite "at least one cover layer disposed over at least one portion of the upper cladding layer and adjacent

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to the mesa stripe." Support for the at least one cover layer is provided by layer 6 shown in FIG. 2, an example thereof being described by the original Specification at page 11, lines 30 through page 12, line 3. Accordingly, Applicants respectfully submit that no new matter has been entered. The cover layer may comprise a dielectric material, a semiconductor material, or any other material that people in the art would adopt to cover a portion of the upper cladding layer that is adjacent to the mesa stripe.

Finally, a new paragraph has been added to each of Claim 1 and 29, which recites "wherein the semiconductor laser device has intervals between adjacent longitudinal oscillation modes, at least one of the intervals being equal to or less than 0.12 nm." This amendment is supported by the original Specification at page 9, lines 32 through page 10, line 1, where a spacing of about 0.12 nm is disclosed for the longitudinal oscillation modes of an exemplary semiconductor layer device. The amendment is further supported by the original specification at page 13, lines 25-26, where a spacing of about 0.1 nm is disclosed; thereby supporting the phrase "or less than" of the amendment. FIG. 8 of the original application illustrates the longitudinal oscillation modes with the spikes in the laser's output spectrum, with the intervals correspond to the spaces between the adjacent spikes. Accordingly, Applicants respectfully submit that this amendment is supported by the original application and does not enter new matter.

Response to the Rejections under 35 U.S.C. § 103

Claims 1, 3-4, 9, 12, 15-17, 20, 25, 27, and 29 were rejected under 35 U.S.C. §103(a) as being obvious over Aoki patent in view of Hayashi patent, and Claims 2, 5-8, 10-11, 13-14, 18-19, 21-24, 26, and 28 were rejected under 35 U.S.C. §103(a) as being obvious over the Aoki patent in view of the Hayashi patent, and further in view of U.S. Patent No. 6,122,299 to DeMars, et al. (the "DeMars patent"). Applicants respectfully traverse the Rejections by arguing, that the Aoki and Hayashi patents teach against the *prima facie* combination suggested by the Rejections, and therefore there is no valid suggestion or motivation in the prior art to make the proffered combination.

The Aoki patent discloses a laser construction having two core layers and an aspect in which a section of the cavity length is tapered. Aoki states that these features cause the laser's output light beam to spread in a manner that is different from conventional laser devices (Aoki patent, Abstract and column 2, lines 15-24). All of the cavity lengths disclosed by Aoki are

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900 μm or less, with cavity lengths of 400 μm to 600 μm being typical. For this unique laser construction, Aoki states that he has established through experiments that improved laser performance ("improved oscillation characteristics") occurs when the threshold current is in the range of 8 mA to 12 mA for a cavity length of 500 μm (Aoki patent, column 6, lines 46-51, read in light of column 6, lines 40-42). The threshold current I_{th} is the minimum amount of current needed to cause stimulated emission of light in the device. In the case where Aoki's 500 μm long device operates best at a threshold current of 8 mA to 12 mA (20% variation from a center value of 10 mA), increasing the cavity length to over 1200 μm , as suggested by the Rejection, would increase the threshold current I_{th} to be well outside of Aoki's preferred range. Aoki also recommends narrow ranges for the threshold currents for each of his other examples, with the extremes of each range being within 12.3% of the center of the range. Even in the case of the Aoki's 900 μm example at column 7, increasing the cavity length from 900 μm to 1200 μm would clearly cause the threshold current to exceed Aoki's recommended range. Accordingly, Applicants respectfully submit that increasing Aoki's cavity length to 1200 μm would not be obvious, regardless of whether the Rejection draws the suggestion from the Hayashi patent or another patent.

The Hayashi patent teaches the construction of laser devices in which the mesa width W and the step-index of refraction Δn are selected according to certain mathematical relationships in order to obtain values of horizontal beam divergences of at least 6.5-degrees with the light being in a single-transverse mode, which Hayashi views as being advantageous (See Hayashi's Summary of the Invention). For his laser construction, Hayashi notes at column 6, lines 49-54, that it is preferable to keep the cavity length of his device between 300 μm and 600 μm in order to decrease the chances of catastrophic optical damage (COD). Thus, Hayashi's example value of 1200 μm (column 10, line 18) noted by the Rejection is not representative of the recommendations and preferred teachings of the Hayashi patent, and appears to be an anomalous choice. Hayashi does provide a second example device at column 14, lines 30-35, where a cavity length of 600 μm is used. Because Hayashi teaches that the range of 300 μm and 600 μm for cavity length is result-effective for his device, one of ordinary skill in the art would choose a value in this range to use in practice rather than the value of 1200 μm .

Because the Hayashi and Aoki devices are very different in purpose and construction, it would not be obvious to modify the features of the Aoki device according to the teachings of the

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Hayashi patent. Moreover, because Hayashi specifically recommends a range of 300 μm and 600 μm for the cavity length, any suggestion to modify the Aoki patent according to the Hayashi patent, even though unsupported for reasons provided above, would have to be based on the 300 μm and 600 μm . Thus, the Hayashi patent actually teaches against the *prima facie* combination proffered by the Rejections, and this is a further reason as to why there is no suggestion and no motivation to make the *prima facie* combination.

The Rejection of Claims 1, 3-4, 9, 12, 15-17, 20, 25, 27, and 29 cites the court case of *In re Aller* (105 USPQ 233) as holding that the discovery of an optimum or working range involves only routine skill in the art. Applicants respectfully traverse the broad application of this holding of the *In re Aller* case. Subsequent court decisions have clarified this holding of *In re Aller* and have limited its scope. These subsequent cases have held that a parameter that is being varied, or optimized, must be *recognized by the prior art references* as having an effect on the desired result or operation of the method or apparatus (see M.P.E.P. § 2144.05, subsection II.B). In the court's words, the parameter must be recognized by the prior art reference as being a "result-effective" variable. Optimizing a parameter of a prior art device or method is non-obvious *when* the prior art does not recognize the parameter as being "result-effective." In the case at hand, the Aoki patent does not teach or suggest the cavity length as being result effective for any purpose. The Hayashi patent does teach that the cavity length is result effective for controlling catastrophic optical damage (COD), but teaches a range of 300 μm and 600 μm as being result effective, which is substantially less than the values of greater than 1200 μm recited by the independent claims, and therefore very different. In the case where the cited references themselves teach against what the applicant has done, the case of *In Re Aller* cannot be used to support the *prima facie* combination because to do so would undo and contradict the teachings of the cited references. For this reason alone, the Rejections cannot be sustained. As explained below in greater detail, Applicants have invented a combination of features that includes cavity length and laminated layer structure features to address an unrecognized source of kinks in the optical output. The new source of kinks is not taught, suggested, or recognized by any of the patents to Aoki, Hayashi, and DeMars.

As to the Rejection of Claims 2, 5-8, 10-11, 13-14, 18-19, 21-24, 26, and 28, Applicants respectfully submit that the addition of the DeMars patent does not cure the defects of the *prima facie* combination used to reject independent Claim 1, and therefore respectfully submit that

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Claims 2, 5-8, 10-11, 13-14, 18-19, 21-24, 26, and 28 are allowable for the same reasons as found for Claim 1. Accordingly, Applicants respectfully submit that Claims 1-29 are allowable over the combination of the Aoki and Hayashi patents, and further over the combination with the DeMars patent as applied to Claims 2, 5-8, 10-11, 13-14, 18-19, 21-24, 26, and 28. Withdrawal of the Rejections is therefore respectfully requested.

Additional Reason for Patentability of the Claims over Aoki and the Hayashi patent

As outline on pages 9-11 and pages 3-5 of the original Specification, Applicants have discovered a new mechanism that generates undesirable kinks in the optical output of the laser device as a function of applied electrical current. To mitigate this new source of kinks, Applicants have invented a combination of features that includes cavity length and laminated layer structure features. One such feature is that the semiconductor laser device has intervals between adjacent longitudinal oscillation modes which are equal to or less than about 0.12 nm. This is recited in each of independent Claims 1 and 29 as "wherein the semiconductor laser device has intervals between adjacent longitudinal oscillation modes, at least one of the intervals being equal to or less than 0.12 nm." This feature is not taught or suggested by any of the patents to Aoki, Hayashi, and DeMars. Applicants submit this as a further reason for the allowability of the claims over the Aoki, Hayashi, and DeMars patents.

The interval spacing of 0.12 nm or less is independent of the wavelength of the light emitted by the device. This is because the interval between two adjacent longitudinal oscillation modes represents the difference between the gains for those adjacent longitudinal oscillation modes, and these gains substantially result from the quantum well structure of the active layer, not the emitted oscillation wavelength. Therefore, the inventions claimed by Claims 1-8 and 10-30 are not to be limited to the emission wavelength bands of the exemplary embodiments described by the present Specification. Dependent Claim 9 is limited to a specific disclosed emission wavelength band of 0.98 μ m.

New Claim 30

New Claim 30 is dependent upon Claim 1, and recites at least one cover layer comprises a dielectric material. Support for Claim 30 is provided in many places of the original Specification, including page 11, lines 30-31, where it is stated that layer 6 may comprise SiN,

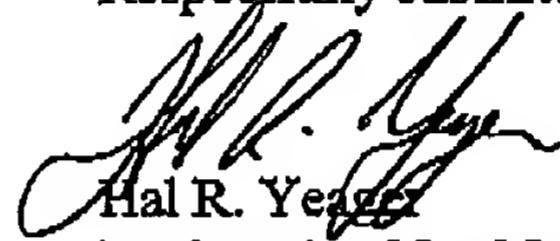
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which is a dielectric material. Accordingly, Applicants respectfully submit that no new matter has been entered by Claim 30.

CONCLUSION

In view of the remarks made above, Applicants respectfully submit that the application is in condition for allowance and action to that end is respectfully solicited. If the Examiner should have any questions or feel that a telephone interview would be productive in resolving issues in the case, she is invited to telephone the undersigned at the number listed below.

Respectfully submitted,



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